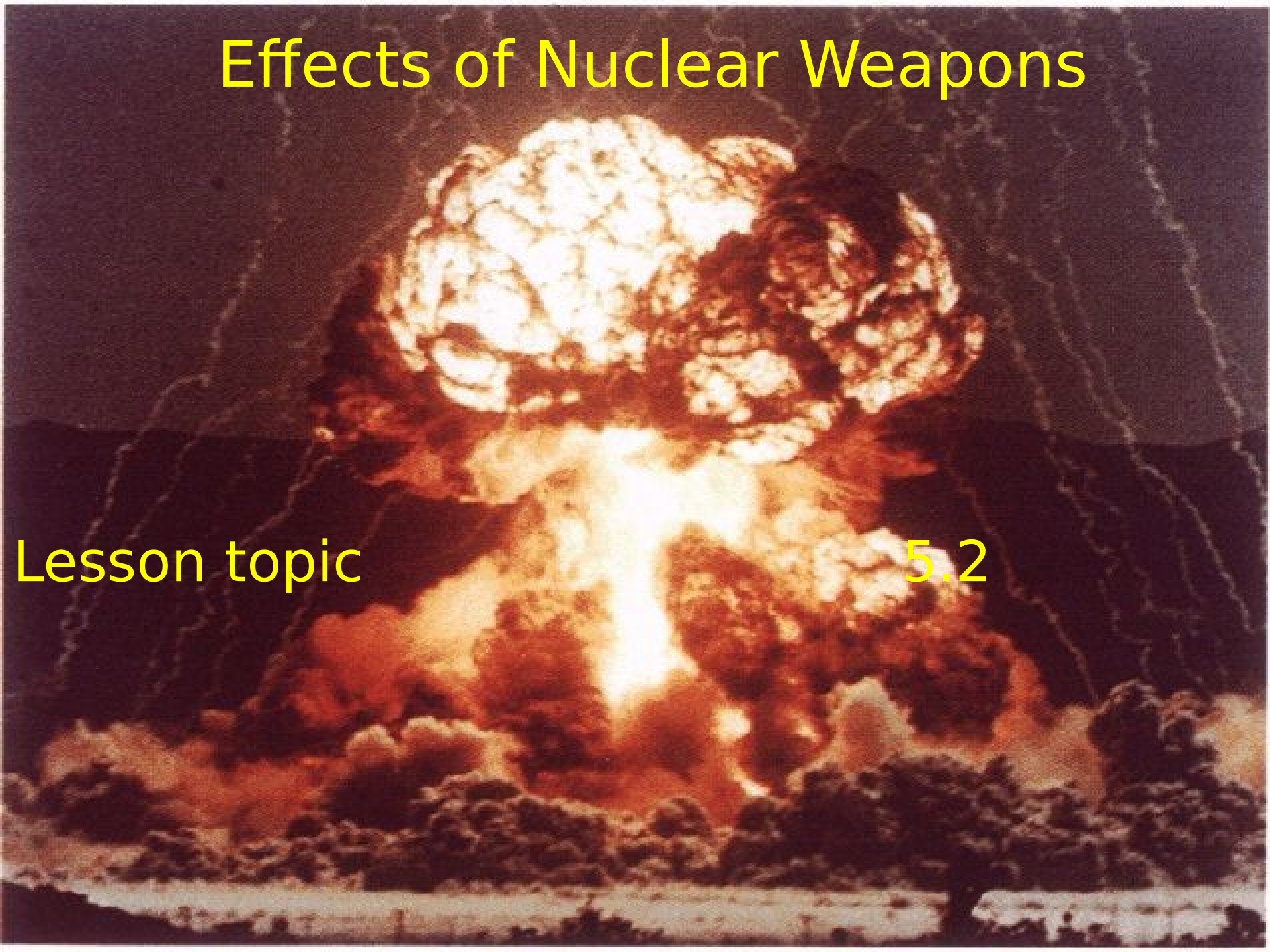
Effects of Nuclear Weapons



Lesson topic 5.2

Enabling Objectives

1. Describe the physiological effects of ionizing radiation
2. Describe the blast and thermal effects on personnel and equipment from a nuclear explosion

Blast Effects

- Equipment/structures
  - Warping, buckling of flight decks
  - Distortion of airplane elevators
  - Distortion of hull framing
  - Cracking of seams
  - Rupturing of boilers
  - Collapsing structures
  - Rupturing of piping systems

Blast effects

- Personnel
  - Ear injury due to over pressure
  - Lung injury due to pressure difference (collapse/over inflate)

Water shock wave effects

- Equipment/structures
  - Foundation damage to machinery
  - Rupture of feed-water & steam lines
  - Damage to gun mounts
  - Damage to electronic systems components and disruption of system performance

Water shock wave effects

- Personnel
  - Body is displaced, thrown against bulkheads/equipment
  - Missile hazards

Thermal effects

- Equipment/structures
  - Spontaneous ignition of flammable and porous materials due to intense heat
  - Fires can spread throughout
- Personnel
  - Eye damage from light released at detonation
  - Burns to exposed skin
  - 100 KT air burst can cause second degree burns up to 4 miles from ground zero

Physiological Effects of Ionizing Radiation

- Types of radiation doses
  - Acute - less than 24 hours
  - Chronic - longer than 24 hours
  - Whole body - Neck to waist including eyes
  - LD 50-30 - lethal dose. 50% personnel will die within 30 days
  - Skin dose - dose to skin from beta and weak gamma radiation that causes burn like injuries

Radiation exposure terms

- TERMS
  - Combat Effective (CE) - personnel can perform task with little problem
  - Combat Ineffective (CI) - Personnel can not perform assigned tasks due to sickness or incapacitation. Less than 25% performance
  - Demanding task (DT)
  - Undemanding task (UT)
  - Performance degraded (PD) - 25 to 75%

Dose related to symptoms

- 0 TO 70 RADS
  - Symptoms - 6 to 12 hours after exposure (CE)
  - None to slight transient headache and nausea
  - Vomiting in up to 5% of personnel in upper dose range
  - No medical care; return to duty; no deaths anticipated

Dose related to symptoms

- 70 to 150 RADS
- Symptoms - 2 to 20 hours (CE)
- Transient mild nausea and vomiting in 5 to 30% of personnel
- No medical care, return to duty; no deaths anticipated

Dose related to symptoms

- 150 to 300 RADS
- Symptoms - 2 hours to 2 days
- Transient mild nausea and vomiting in 20 to 70% of personnel
- Mild to moderate fatigability and weakness in 25 to 60%
- Low end range less than 5% deaths
- High end range deaths may occur for more than 50%; survivors return to duty

Dose related to symptoms

- 300 to 530 RADS
- Symptoms - 2 hours to 3 days
- Transient moderate nausea and vomiting in 50 to 90% of personnel
- Moderate fatigability in 50 to 90%
- Low end range less than 10% deaths
- High end range deaths may occur for more than 50%; survivors return to duty

Dose related to symptoms

- 530 to 800 RADS
- Symptoms - 2 hours to 3 days
- Moderate to severe nausea and vomiting in 80 to 100% of personnel
- From 2 to 6 weeks moderate to severe fatigability and weakness in 90 to 100%
- Low end range more than 50% deaths at six weeks
- High end range deaths may occur for 99% at 3 1/2 weeks

Dose related to symptoms

- 830 to 3000 RADS
- Symptoms - 30 MIN to 2 days
- Severe nausea, vomiting, fatigability, weakness, dizziness, and disorientation
- 1000 RADS 100% deaths in 2 to 3 weeks
- 3000 RADS 100% deaths in 5 to 10 days

Dose related to symptoms

- 3000 to 8000 RADS
- Symptoms - 30 MIN to 5 days
- Severe nausea, vomiting, fatigability, weakness, dizziness, disorientation, and fluid imbalance
- 4500 RADS 100% deaths in 2 to 3 days

Dose related to symptoms

- Greater than 8000 RADS
- Symptoms - 30 MIN to 1 day
- Severe and prolong nausea, vomiting, fatigability, weakness, dizziness, disorientation, and fluid imbalance
- 8000 RADS 100% deaths in 1 day

Cumulative nature of radiation exposure

- Damage depends on length of exposure and total dose received
- Body cannot repair all damage
- Each subsequent exposure adds to permanent damage
- Latent effects
  - Cataracts, cancers (Leukemia) and shortened life span

Radiation exposure guides

- Wartime
  - Setting Maximum Permissible Exposure (MPE)
  - Considers past and future exposures
  - Set by Commanding Officer on DCA's recommendation
  - Usually set at 150-R but depends on tactical demands

Summary and Review

- Blast effects
- Water shock wave effects
- Thermal effects
- Physiological effects of ionizing radiation